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APPLICANT : FUJITSU LTD;

INVENTOR : ISHII TOMOYUKI;

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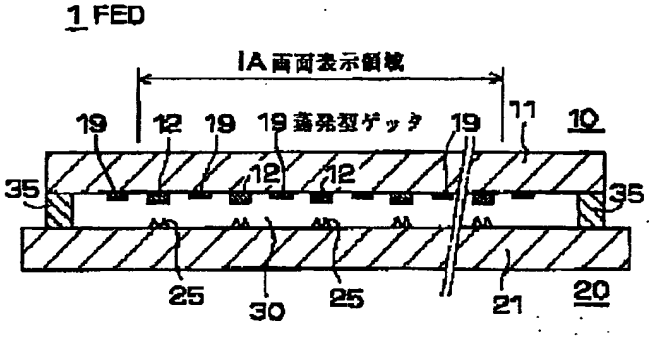
TITLE : FLAT TYPE DISPLAY DEVICE AND ITS MANUFACTURE



ABSTRACT : PURPOSE: To maintain an ultra-high vacuum condition by restraining gas diffusion, and stabilize display by arranging an evaporation type getter exposed in a vacuum clearance between two panels on an inner wall surface in an image screen display area in which a field emission type negative electrode is arranged.

CONSTITUTION: In an image screen display area 1A being a screen of matrix display, an interval 30 between a front side panel 10 having a fluorescent screen 12 on an inside surface and a back side panel having emitters 25 on an inside surface is set in about 100μm, and an ultra-high vacuum is kept. A belt-like evaporation type getter 19 is uniformly arranged over the whole area 1A between the panel 10 and the fluorescent screen 12. The getter 19 is composed of a barium thin film or the like formed by a mask evaporation method, and a thickness is about 1000^{-}, and is sufficiently smaller than the clearance 30. Therefore, speedy gettering is performed to blowoff of gas in the area 1A. The getter 19 may be arranged on both front and back sides in the area 1A. The getter 19 is evaporated in a condition of being held in a vacuum after surface purification processing of the panel.

CLAIMS

[Claim(s)]
[Claim 1] [the panel by the side of the back with much field emission type negative poles for the screen display which excites alternatively the panel and said fluorescence film by the side of the front with a fluorescence film] The flat form display device characterized by coming to prepare the evaporated type gette exposed to said vacuum gap in the inner wall surface in the screen display field which is the flat form display device of the structure which counters through a vacuum gap, and is a field where said field emission type negative pole has been arranged.
[Claim 2] The flat form display device according to claim 1 characterized by coming to arrange said evaporated type gette almost equally to each pixel of a screen display.
[Claim 3] The flat form display device according to claim 1 or 2 characterized by coming to prepare said evaporated type gette in the inner wall surface of each of said panel by the side of the front and the back.
[Claim 4] The flat form display device according to claim 1 to 3 characterized by having the hollow which increases the size of said vacuum gap locally, and coming to prepare said evaporated type gette in said screen display field at the bottom of said hollow.
[Claim 5] The flat form display device according to claim 1 to 3 characterized by having the partition which divides said vacuum gap in said screen display field, and coming to prepare said evaporated type gette in the side of said partition.
[Claim 6] It is the manufacture method of a flat form display device according to claim 1 to 5. the inside of a vacuum — said a pair of panels by the side of the front and the back — on the other hand — or the manufacture method of the flat form display device characterized by carrying out opposite arrangement of said a pair of panels, and sealing the circumference, holding a vacuum state after forming said evaporated type gette in both.
[Claim 7] The manufacture method of the flat form display device which is the manufacture method according to claim 6, and is characterized by forming said evaporated type gette, holding a vacuum state after performing surface purification processing to both said both [one side or] in a vacuum. [a pair of]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the flat form display device equipped with the source of an electron of a large number which consist of the field emission type negative pole as an excitation means of a fluorescence side (electron gun), and its manufacture method.
[0002] A high definition high-intensity display is possible for the display device (FED:FieldEmitter Desplay) using field emission (it is also called cold emission), and it attracts attention as a next-generation display device.
[0003]
[Description of the Prior Art] FED is the display tube of the shape of flat [with a thickness of about several millimeters which carried out opposite arrangement of a pair of panels through the minute gap, and sealed the circumference of these panels]. A fluorescence film is prepared in the inside of the front side panel, and the field emission type negative pole of micron size is arranged for each pixel of every on the back side panel. The arrangement field of the field emission type negative pole is a screen display field.
[0004] When manufacturing FED, the chip-off pipe which carried out [tacking] to the exhaust port of the periphery part of the panel which is one side beforehand simultaneously with sealing around a panel is pasted up, and an inside is exhausted through a chip-off pipe after that. And a chip-off pipe is blown out, an exhaust port is closed and an internal vacuum gap is sealed.
[0005] In such FED, in order for the field emission type negative pole (henceforth an "emitter") to function

certainly, it is necessary to maintain the gap of an emitter and a fluorescence side what is called at an ultrahigh vacuum of at least 10-7 - 10-8Torr. For this reason, the un-evaporating type gette (bulk getter) is usually being fixed in the chip-off pipe.

[0006] Moreover, in the former, the technique of attaining large capacity-ization of bulk getter is proposed by preparing the slot which surrounds the whole fluorescence side (display surface) to the inside of the front side panel, and embedding bulk getter into the slot (JP,H5-121015,A).

[0007]

[Problem to be solved by the invention] When using bulk getter like before, the arrangement position will be limited. That is, thickness is about 150 micrometers and the thinnest bulk getter cannot store bulk getter in an about 100-micrometer internal gap, either.

[0008] Therefore, the screen display field and gette arrangement position which gas discharge during use tends to produce will separate, the gas which gushed from the inner wall of the screen display field was spread around, without adsorbing immediately, and there was a problem of being easy to produce contamination of a fluorescence side or an emitter and breakage of the emitter by arc discharge. Moreover, since a gap is narrow and the KONDAKU wardrobe of the gas flow was small, the degree of vacuum in a screen display field was spoiled locally, and the problem that a display became unstable also had it.

[0009] This invention was made in view of such a problem, suppresses the gas diffusion in a screen display field as much as possible, maintains a high vacuum state, and aims at stabilizing a display.

[0010]

[Means for solving problem] As shown in drawing 1 in order that the equipment concerning invention of Claim 1 may solve an above-mentioned technical problem [the panel by the side of the back with much field emission type negative poles for the screen display which excites alternatively the panel and said fluorescence film by the side of the front with a fluorescence film] It comes to prepare the evaporated type gette exposed to said vacuum gap in the inner wall surface in the screen display field which is the flat form display device of the structure which counters through a vacuum gap, and is a field where said field emission type negative pole has been arranged.

[0011] It comes to arrange the equipment concerning invention of Claim 2 almost equally to each pixel of a screen display of said evaporated type gette. As for the equipment concerning invention of Claim 3, it comes to prepare said evaporated type gette in the inner wall surface of each of said panel by the side of the front and the back.

[0012] The equipment concerning invention of Claim 4 has the hollow which increases the size of said vacuum gap locally in said screen display field, and it comes to prepare said evaporated type gette in the bottom of said hollow.

[0013] The equipment concerning invention of Claim 5 is equipped with the partition which divides said vacuum gap, and it comes to prepare said evaporated type gette in the side of said partition. After the manufacture method of the flat form display device concerning invention of Claim 6 forms said evaporated type gette in a vacuum in both said both [one side or] by the side of the front and the back, holding a vacuum state, it carries out opposite arrangement of said a pair of panels, and seals the circumference. [a pair of]

[0014] The manufacture method of the flat form display device concerning invention of Claim 7 forms said evaporated type gette, holding a vacuum state, after performing surface purification processing to both said both [one side or] in a vacuum. [a pair of]

[0015]

[Function] The impure gas which gushed from the inner wall of the screen display field is promptly adsorbed by the neighboring evaporated type gette.

[0016] By equal-ization of the gette arrangement to each pixel, irrespective of the position of a screen display field, gettering is performed uniformly and the homogeneity of display properties is held. If both panels are sealed in a vacuum and an internal gap is sealed, after sealing under atmospheric pressure, unlike the case where an inside is exhausted, an internal gap can be made into a high vacuum regardless of a KONDAKU wardrobe.

[0017] Since the inside of a hollow becomes a high vacuum in the neighborhood of a hollow with an evaporated type gette to a bottom compared with the circumference when the arc discharge by gas discharge arises, gas becomes depressed according to the degree-of-vacuum slope, it passes and flows in (spread), and a spread of arc discharge is suppressed.

[0018]

[Working example] The sectional view in which drawing 1 shows the composition of FED1 of the 1st example, the fragmentary perspective view in which drawing 2 shows the internal structure of FED1, and drawing 3 are the figures showing an example of the structure of the source 22 of an electron.

[0019] FED1 consists of a front side panel 10 which uses the glass board 11 as a base, and a back side panel 20

which uses the glass board (or silicon board) 21 as a base, and is a flat form display device in which a full color matrix display is possible. Both the panels 10 and 20 prepare about 100-micrometer gap, opposite arrangement is carried out, and the periphery part of the opposite field is sealed by the sealing glass layer 35. The internal gap 30 is the vacuum of 10-7 - 10-8Torr, and the gap size is equalized by scattering arrangement of the bead spacer which is not illustrated.

[0020] In the screen display field IA used as the screen of a matrix display, the fluorescence film 12 is formed in the inside of the front side panel 10, and the emitter 25 for exciting the fluorescence film 12 to the inside of the back side panel 20 is arranged.

[0021] Like drawing 2 , the arrangement pattern of the fluorescence film 12 is used as the stripe pattern with which the three primary colors for a full color display (R, G, B) interchange by turns about one way, and the anode electrode which consists of a transparent electric conduction film and which is not illustrated is prepared between each band-like fluorescence film 12 and the glass board 11.

[0022] The electrode matrix is constituted in the back side panel 20 by the cathode electrode 23 arranged on the glass board 21, and the gate electrode 26 prolonged in the same direction as the fluorescence film 12. The cathode electrode 23 and the gate electrode 26 cross through an insulating layer 24, and the source 22 of an electron which demarcates the unit luminescence field of a matrix display to each of that intersection is formed. The size of a unit luminescence field is a 100-micrometer angle grade, for example.

[0023] [the source 22 of an electron] like drawing 3 Form an opening in the circumference of the gate electrode 26 with the opening 26a to which the conic emitter (it is also called an emitter tip) 25 electrically united with the cathode electrode 23 and an emitter 25 are exposed, and an emitter 25, and [and the insulation with the gate electrode 26] It consists of insulating layers 24 for maintaining, and has hundreds or more emitters 25 in fact. Since the formation method of the source 22 of an electron is well-known, the explanation is omitted here.

[0024] If predetermined voltage is impressed between an emitter 25 and the gate electrode 26, field emission will arise in the tip part of an emitter 25. The source 22 of an electron and the fluorescence film 12 which counters can be made to emit light alternatively by following, for example, choosing the cathode electrode 23 and the gate electrode 26 in line sequential form, and making an electron beam eject from the specific source 22 of an electron. In FED1, 1 pixel of a matrix display consists of unit luminescence fields of three colors located in a line in the extended direction of the cathode electrode 23, and the gradation sequence display of each color by luminescence time control etc. is performed according to the display color of a pixel.

[0025] In order that [in addition,] the cathode electrode 23, the gate electrode 26, and an anode electrode may be drawn from the screen display field IA to a panel end and may connect these electrodes with an external circuit It piles up with the panel size by the side of the front and the back, and the position is selected so that the electrode derivation part of one panel may ****** to the panel of another side.

[0026] Now, in FED1, the band-like evaporated type gette (flash getter) 19 is equally formed over each fluorescence film 12 of the front side panel 10 like drawing 1 and drawing 2 throughout the screen display field IA.

[0027] The evaporated type gette 19 is BaAl4, for example. It is the barium thin film formed by the mask vapor-depositing method which uses powder as materials and covers a covering side partially, and thickness is about 1000A small enough compared with a vacuum gap size.

[0028] Quick gettering to gas discharge in the screen display field IA is performed by the evaporated type gette 19. As a result, in FED1, gas diffusion is localized, an internal high vacuum state is maintained, even if there is a lot of gas discharge which causes especially arc discharge, an arc does not spread, but breakage of an emitter 25 is suppressed to the minimum.

[0029] After preparing a fluorescent substance 12, the sealing glass for sealing, and a bead spacer in a suitable order by screen-stencil etc. on the glass board 11 on the occasion of manufacture of the above composition of FED1, surface purification processing is performed in a vacuum. As surface purification processing, baking powder, electronic irradiation, ion irradiation, ultraviolet-rays irradiation, plasma polymerization, etc. occur. Moreover, you may add the baking powder in the inside of hydrogen atmosphere.

[0030] Without being exposed to the atmosphere from the state or hydrogen atmosphere where the vacuum was held, following surface purification processing, where processing environment is made into a vacuum, the evaporated type gette 19 is vapor-deposited. And after vapor deposition holds a vacuum state.

[0031] On the other hand, after preparing the electrode matrix including the source 22 of an electron on glass 21 also about the back side panel 20, surface purification processing is performed like the front side panel 10. However, in addition to each above-mentioned processing, aging which operates the source 22 of an electron in a vacuum is performed. And after aging holds a vacuum state.

[0032] Then, the panel 10 of the both sides maintained at the vacuum state and 20 are arranged under the vacuum environment of 10-7 which is the degree of vacuum of the internal gap at the time of use - 10-8Torr, the

circumference is sealed by hot plate heating etc., and an opposite gap is sealed. Thereby, FED1 is completed.
[0033] Thus, the pure vacuum gap 30 where the evaporated type gette 19 functions effectively over a long period of time can be formed by performing substantially continuously a series of processings in which it results in sealing through gette vapor deposition from surface purification processing, in a vacuum.
[0034] In addition, the production equipment which was equipped with two or more vacuum rooms suitable for processing of each stage and the conveyance means containing a manipulator and into which each vacuum room was divided with the load lock mechanism is suitable for manufacture of FED1.
[0035] Drawing 4 is the top view showing the composition of FED2 of the 2nd example typically. In drawing 4 , the same mark is given to drawing 1 – the constituent factor corresponding to drawing 3 . Also in the following figures, it is the same.
[0036] The basic composition of FED2 is the same as that of above-mentioned FED1. However, in FED2, the evaporated type gette 19 and 19B are prepared in both by the side of the front in the screen display field IA, and the back.
[0037] That is, like drawing 4 (A), the band-like evaporated type gette 19 is formed between each fluorescence film 12 at the front side panel 10, and the square-shaped evaporated type gette 19B is formed in the center of 2x2 sources 22 of an electron contiguous to the back side panel 20.
[0038] Drawing 5 is the perspective view showing the structure of the important section of FED3 of the 3rd example. The square-shaped evaporated type gette 19C is formed so that FED3 may surround each source 22 of an electron from four corners on the back side panel 20 like above-mentioned FED2. However, in FED3, the hollow 24a of the square form about 10 micrometers deep is formed in the surface part of an insulating layer 24, and the evaporated type gette 19C is formed in the bottom of the hollow 24a.
[0039] Since the inside of a hollow 24a becomes a high vacuum by this compared with the circumference when the arc discharge by gas discharge arises in the neighboring source 22 of an electron of a hollow 24a, gas becomes depressed according to the degree-of-vacuum slope, it flows into 24a, and a spread of the arc discharge to other sources 22 of an electron is suppressed.
[0040] Drawing 6 is the perspective view showing the internal structure of FED4 of the 4th example. Plane view form has the straight line-like partition 51 between each fluorescence film 12 of the front side panel 10, and, as for FED4, the plane view form which surrounds each source 22 of an electron on the back side panel 20 has the lattice-like partition 52. The vacuum gap 30 is divided at equal intervals by these partitions 51 and 52 for every unit luminescence field, and the high definition display without cross talk (there is no luminescence blot) is attained.
[0041] And in FED4, the evaporated type gette 19D is formed so that the side of a partition 51 may be covered, and the evaporated type gette 19E is formed so that the side of a partition 52 may be covered. These evaporation type gette 19D and 19E can be easily formed by arranging a panel 10, and 20 and a mask in the position of the direction of slant to an evaporation source when vapor-depositing.
[0042] According to the above-mentioned example, there are no restrictions of the arrangement space concerning a thickness size, and adsorption area can be increased sharply. For this reason, prepare the deep slot which surrounds the screen display field IA like before, it becomes unnecessary to embed bulk getter, and the drawer of the electrode from the screen display field IA to a panel end becomes easy.
[0043] In an above-mentioned example, also about the front side panel 10, a band-like hollow (slot) may be prepared by etching of the glass board 11 etc., and the evaporated type gette 19 may be formed into it. Moreover, the evaporated type gette 19, the form of 19 B-E, and an arrangement position are not limited to the example of illustration. For example, in the front side panel 10, division arrangement of the fluorescence film 12 may be carried out for every unit luminescence field, and you may form the evaporated type gette 19 so that an inside may be covered except for the fluorescence film 12.
[0044] In an above-mentioned example, panel sealing cannot be depended on sealing glass, but can also be performed by other methods, such as a metal seal and anode junction. What is necessary is just to select suitably the quality of the material of each part, form, a size, arrangement relations, etc. according to a use. When using a silicon board as a base of the back side panel 20, the electric conduction layer which serves as the cathode electrode 23 by impurities diffusion can be formed, and the conic emitter 25 can be formed by pattern etching of silicon after that.
[0045] In an above-mentioned example, if an evaporated type gette is formed in the electronic discharge side of an emitter 25, since secession of gas will be lost and it will only be adsorbing, the noise of the field emission resulting from attachment and detachment of gas is reduced, the indecement factor (trigger) of arc discharge also decreases, and improvement in device performance can be aimed at.
[0046]
[Effect of the Invention] Since a gette is arranged in the screen display field where gas discharge during use

tages place easily according to invention of Claim 1 or Claim 5, gas diffusion is suppressed as much as possible, a high vacuum state is maintained, and a display can be stabilized.

[0047] According to invention of Claim 2, in addition to an above-mentioned effect, the variation in the field emission characteristic in a screen display field can be prevented. According to invention of Claim 6 and Claim 7, a display device with the pure vacuum gap where contamination in the manufacture stage of an evaporated type gette is prevented, and an evaporated type gette functions effectively over a long period of time can be manufactured.

[Translation done.]